

Irrigation Management of Barley (Feed and Malting)

Barley is an annual grain, grown extensively under irrigation for feed as grain and forage, and to a limited extent for malting purposes. Barley is recognized as one of the world's most widely adapted crops, particularly important as a fat and energy producing food. In Alberta, most of the barley produced is used for livestock feed, malt and malt products.

In 1985, 15 per cent of the total irrigated acreage was used for the production of barley.

Barley is one of the most salt tolerant crops grown under irrigation. During the germination and seedling stages of growth, barley is fairly tolerant of soil salinity (4 to 5 mS/cm). Once established, this tolerance increases. If used as a forage, barley will tolerate salinity levels as high as 6 mS/cm without yield reductions. When grown for grain purposes, barley's tolerance to salinity increases to 8 mS/cm before yield reductions will occur.

Optimum air temperature for good barley production is from 15 - 20°C.

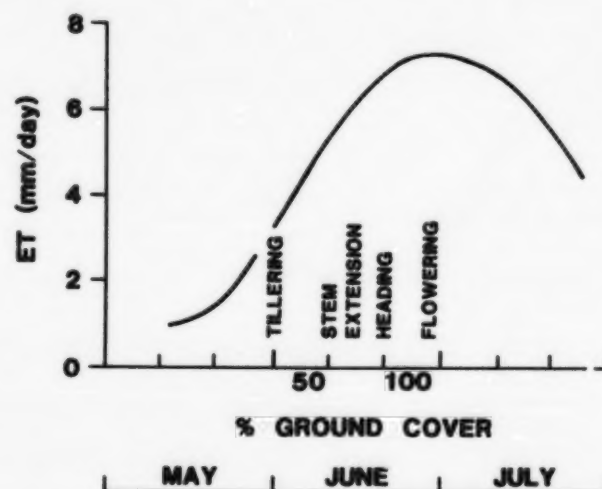
Crop water requirements and crop yield

In areas where there are no soil restrictions, barley develops an active root zone of approximately 1.0 m (3.3 ft). The seeding date for barley is generally from April 27 to May 7, and approximately 90 to 100 days are needed for the crop to reach maturity. Barley seeding may extend well into June, but later seeding results in a lower yield.

The growing season for barley is from mid-May to mid-August, with a seasonal crop water requirement of 390 mm (15.4 in.) for feed barley and 430 mm for malting barley. Over a 30-day period, maximum daily water use will be approximately 6.5 mm/day (0.26 in./day). During initial growth stages, crop water use will range from 1.0 - 3.0 mm/day (0.04 to 0.12 in./day) rising to a high of 7.0 mm/day (0.28 in./day) during the flag leaf and flowering stages of crop growth. By the time the crop begins to flower, full canopy cover is established and maximum rooting depth has been achieved (See figure 1). Approximately 70 per cent of the water requirement for barley comes from the top 50 cm (2 ft) of the root zone.

During the growing season there are two critical growth periods (critical water requirement periods)

where moisture stress will cause a reduction in yield. The first is when tiller initiation and development begin. Soil moisture stress during this stage will result in a growth and yield reduction that cannot be overcome by optimum soil moisture conditions during the later stages of growth.



Crop water use of barley during the growing season

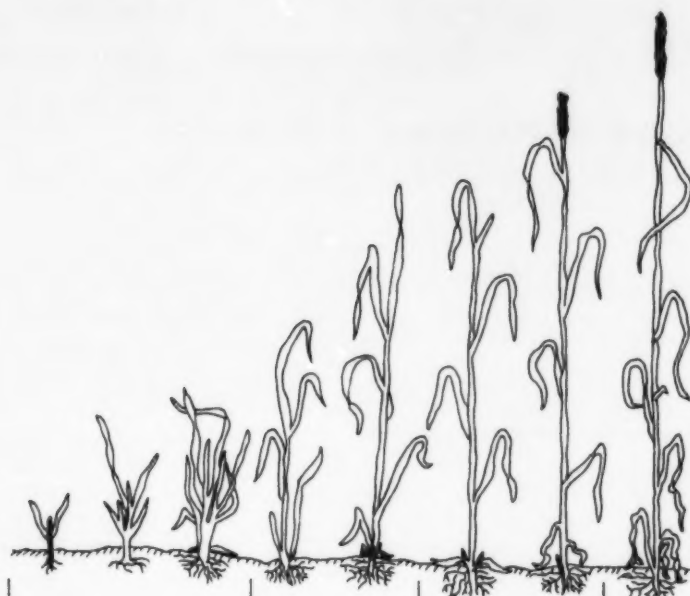
The second critical growth stage is flowering. The effects of moisture stress at this stage are not as severe as at tillering but the critical period is more defined. Limiting water during this time period can cause flowers to abort, consequently reducing yield.

During the critical water requirement periods it is important to monitor soil moisture conditions and irrigate accordingly. As with other crops, a positive relationship exists between water consumption and barley yield (see figure 2).

Comments

Malt barley requires slightly more water over the growing season than does feed barley. The extra water helps to keep the protein content of the grain at a level which maltsters prefer and at the same time maximizes starch content. Like other crops, a positive relationship

Growth and development of feed barley and malting barley



GROWTH PERIODS	TILLERING	STEM EXTENSION	FLOWERING	RIPENING
POST EMERGENCE DATES	25 - 30 DAYS	45 - 55 DAYS	60 - 70 DAYS	90 - 100 DAYS
CROP * ROOTING DEPTH	1.5cm/DAY	2.5cm/DAY	MINIMAL ROOT EXTENSION	
MOISTURE SENSITIVE PERIOD..				
AVERAGE E.T.	1.0 - 4.0mm/DAY	4.0 - 6.0mm/DAY	6.0 - 7.0mm/DAY	< 7.0mm /DAY

* Maximum rooting depth will occur approximately by the time flowering begins.

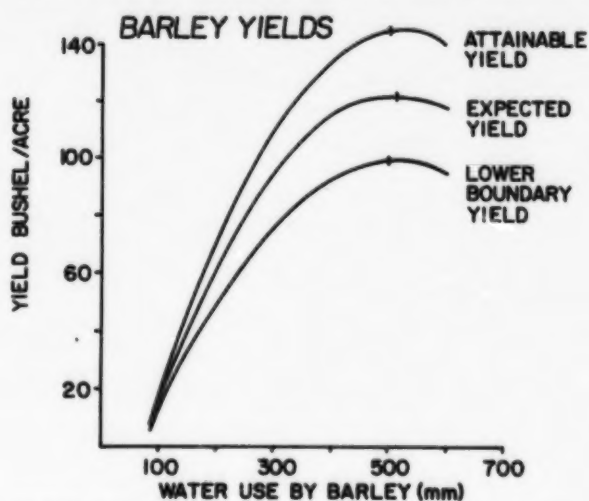
** For optimum production, the first irrigation will be required before the crop enters into its water-sensitive period.

The above times, depths and amounts are only average values for this particular crop. These values will change depending on the variety and area where this crop is grown.

exists between water consumption and yield.

Barley is not as tolerant as wheat to prolonged or excessive drought; however, it will tolerate soil moisture depletion of 65 to 70 per cent during grain formation and 80 to 90 per cent near maturity. Stress at any stage of growth will reduce yield, severity of loss will depend on the length and degree of the drought period.

Excessive soil moisture during the jointing and boot stage, especially where nitrogen fertility is high, promotes vegetative growth which often results in lodging as the grain develops. Irrigation after grain is well developed also promotes lodging owing to the weight of water on the plants and the reduced root support in the



Graph showing the relationship between water consumption and yield.

wet soil. Excessive soil moisture during the moisture-sensitive period will not depress yield as it will during earlier and later stages of growth.

Maintaining good soil moisture conditions throughout the season (above 50 per cent allowable depletion) is important for optimizing yield. But just as important is the final irrigation. Centre pivot operators have little trouble in irrigating up to the soft dough stage. But irrigation farmers who surface irrigate or use a side-wheel-roll system need to manage their irrigation a little differently. Surface irrigators are not limited by crop height but are generally limited as to by the time the crop can be irrigated by labor constraints and system design. Side-wheel-roll operators are limited by crop height. The final irrigation should take place when sufficient time is still available to irrigate the entire field, even when soil moisture conditions are above the 50 per cent allowable depletion level. Regardless of the method of irrigation used, adequate soil moisture conditions are needed for the entire season to ensure full crop development.

Irrigation management information

For further information regarding irrigation management of barley, contact your nearest irrigation branch office. Location of these offices is: Lethbridge, 381-5136; Vauxhall, 654-2161; Airdrie, 948-8511; Taber, 223-7908; Strathmore, 934-3356; Brooks, 362-1212; Bow Island, 545-2231; Medicine Hat, 529-3616. North of Calgary, contact the Airdrie office or your local district agriculturist for assistance.

Soil

Soils can vary greatly in texture from being very fine (clay) to very coarse (sand) within a crop root zone. Because soil texture can change quite quickly so can the amount of water that the soil is able to hold.

Texture	Available Moisture
Loamy sand	8-12 mm/0.1 m (0.9-1.4 in./ft)
Sand loam	10-15 mm/0.1 m (1.2-1.8 in./ft)
Loam	14-18 mm/0.1 m (1.7-2.1 in./ft)
Sand clay loam, clay loam, clay	15-20 mm/0.1 m (1.8-2.4 in./ft)
Silty clay loam, silt loam	16-22 mm/0.1 m (1.9-2.6 in./ft)

It is important to know and to be able to calculate the amount of moisture present in the soil root zone in order to understand the amount of moisture available for crop use. Allowable depletion level is the amount of soil moisture that can safely be removed from the root zone by a crop before an irrigation is required. For Barley, the allowable depletion level has been determined to be 50%. The simplest way to determine soil moisture content is by the "feel" method. By feeling, squeezing and observing a handful of soil, one can determine the amount of moisture present in the soil. The following chart outlines the various characteristics of soil based on different contents of water.

	Feel or Appearance of Soils			
	PERCENT OF AVAILABLE MOISTURE REMAINING	MODERATELY COARSE TEXTURE	MEDIUM TEXTURE	MODERATELY FINE TEXTURE
DO NOT IRRIGATE	At field capacity 100	Upon squeezing no free water appears on soil but wet outline of ball is on left hand.	Same as sandy loam.	Same as sandy loam.
	75 to field capacity	Forms a weak ball, breaks easily, will not slide.	Forms a ball and is very pliable; slicks readily if relatively high in clay.	Easily ribbons out between fingers, has a slick feeling.
IRRIGATE SPEC. CROPS	50 to 75	Tends to ball under pressure but seldom will hold together	Forms a ball; somewhat plastic; will sometimes slick slightly with pressure.	Forms a ball, will ribbon out between thumb and forefinger.
IRRIGATE	25 to 50	Still appears to be dry, will not form ball with pressure.*	Somewhat crumbly but will hold together from pressure.	Somewhat pliable, will ball under pressure.
	0 to 25	Dry, loose, single-grained, flows through fingers.	Powdery, dry, sometimes slightly crusted but easily breaks down into powdery condition.	Hard, baked, cracked; sometimes has loose crumbs on surface.

* Ball is formed by squeezing a handful of soil firmly.